



Patrick A. Byorth

Director of Montana Water, Western Water and Habitat Project

Michelle McGree
Montana Fish, Wildlife & Parks
Habitat Protection Bureau
PO Box 200701
Helena, MT 59620-0701

Transmitted via email to: mmcgree@mt.gov

November 29, 2017

Dear Ms. McGree,

Attached please find a Future Fisheries Improvement Program (FFIP) application packet for the Dry Creek Channel Fish Passage Project. This is a collaborative project in partnership with two landowners, Lonny Walker and the Dry Creek Conservation Partners, Trout Unlimited, the Greater Gallatin Watershed Association, and the Dry Creek Canal Company. This is one of three associated projects in this greater watershed restoration effort. First, FFIP supported the naturalization of the Walker reach of Dry Creek, which will increase pool availability and bank cover, and restore woody riparian vegetation on a reach directly downstream of the Dry Creek Canal crossing. A second project will decrease high sediment loads near the headwaters, where landowners plan to slope 4,448 feet of vertical eroding banks, build 0.68 acres of new inset floodplain benches, and revegetate new banks. This bank restoration was the subject of a 319 grant application, which provided partial funding for bank work. The final phase and subject of this grant application is installing a fish bypass directing Dry Creek flows under the Dry Creek Canal crossing, which cut off fish passage for decades, seasonally creating a barrier to fish migrations and dewatering the channel. The fish bypass will allow spawning salmonids to access spawning habitats year-round and increase recruitment by allowing returning migrants to pass the canal and reach the East Gallatin River.

These three projects will improve water quality and spawning habitat by decreasing fine sedimentation, improve connectivity in Dry Creek, and enhance spawning, rearing, and pool habitats for resident fish and those migrating upstream from the East Gallatin River.

We are requesting \$48,521 of an estimated \$121,978 budget. Dry Creek Partners have committed to over \$72,000 in cash match for design and construction. Gilliland and Associates will donate \$550 in-kind for oversight and TU has committed \$692 in-kind for permitting and oversight. We also expect to use in-kind volunteer labor for planting, but

have not assigned a dollar value to that time. We hope you and the FFIP Citizens' Panel will find the project worthy of your support. Please feel free to contact me with questions.

Sincerely,



Patrick A. Byorth

FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

Please fill in the highlighted areas
all sections (IA, IB, IC, etc.) must be addressed or the application will be considered invalid

I. APPLICANT INFORMATION

A.	Applicant Name:	Patrick Byorth		
B.	Mailing Address:	321 E. Main Street, Suite 411		
C.	City:	Bozeman	State:	MT
			Zip:	59715
	Telephone:	406-522-7291	E-mail:	pbyorth@tu.org
D.	Contact Person:	Patrick Byorth		
	Address if different from Applicant:			
	City:		State:	
			Zip:	
	Telephone:		E-mail:	
E.	Landowner and/or Lessee Name (if other than Applicant):	Lonny Walker		
	Mailing Address:	PO Box 94		
	City:	Belgrade	State:	MT
			Zip:	59715
	Telephone:	406-580-7556	E-mail:	drycreekroadfarm@gmail.com

II. PROJECT INFORMATION*

A.	Project Name:	Dry Creek Fish Passage Project		
	River, stream, or lake:	Dry Creek		
	Location:	Township:	Range:	Section:
		1 North	4 East	3
		Latitude:	Longitude:	<i>within project (decimal degrees)</i>
		45.874607	-110.207877	
	County:	Gallatin		

Dry Creek fish passage

B. Purpose of Project:

The purpose of this project is to reconnect Dry Creek to the East Gallatin River past a large canal that has intercepted the stream for decades. Dry Creek is a tributary of the East Gallatin River draining the Horseshoe Hills North of Belgrade, Montana. The stream primarily supports brown trout, but mountain whitefish, brook and rainbow trout are present. The Dry Creek fishery suffers under several limiting factors including channelization due to an old railroad grade and for agriculture, sedimentation, irrigation withdrawals, and is intercepted by the Dry Creek Canal which likely acts as a seasonal passage barrier. Fish migrating upstream in Dry Creek are blocked at the canal, and any downstream migrants are likely lost into the canal. A group of concerned landowners and their partners along Dry Creek are undertaking a watershed restoration effort to restore fisheries passage, improve water and habitat quality, and restore stream function. In 2017, FFIP supported naturalization of Dry Creek below the junction with the Dry Creek Canal. This grant request is in support of installing a bypass structure that will separate Dry Creek from the Dry Creek Ditch Company Canal to restore connectivity historically disrupted when the canal was constructed. The canal intercepts Dry Creek, reducing stream flow below, blocking migrations, and causing entrainment of migratory adult and juvenile fishes. Another associated project will restore almost a mile of vertical, eroding streambanks by sloping banks, revegetating, and establishing a floodplain toe.

C. Brief Project Description:

The goal of the fish bypass system would be to reconnect the lower reaches of Dry Creek below the canal with its upper reaches to help restore the fishery. Some elements of the fish bypass structure include:

- Route lower flows under the Dry Creek Canal in a culvert constructed with fish passage features;
- Larger flows would be routed through the headgate on Dry Creek or into the canal if the headgate is closed. This is consistent with how larger flows are currently handled at the site; and
- Minimal modifications to the Dry Creek Canal Company's infrastructure at the site.

D. Length of stream or size of lake that will be treated: 200 feet

E. Project Budget:

Grant Request (Dollars): \$ 48,521

Contribution by Applicant (Dollars): \$ In-kind \$ 692
(salaries of government employees are not considered as matching contributions)

Contribution from other Sources (Dollars): \$ 72,774 In-kind \$ 550
(attach verification - See page 2 budget template)

Total Project Cost: \$ 121,987

F. Attach itemized (line item) budget – see template

Dry Creek fish passage

- Attach **specific project plans, detailed sketches, plan views, photographs, maps, evidence of landowner consent, evidence of public support and fish biologist support, and/or other information necessary to evaluate the merits of the project. If project involves water leasing or water salvage complete a *supplemental questionnaire*** (fwp.mt.gov/habitat/futurefisheries/supplement2.doc).
- H. **Attach land management & maintenance plans that will ensure protection of the reclaimed area.**

III. PROJECT BENEFITS*

- A. What species of fish will benefit from this project?:

Dry Creek and the nearby East Gallatin support primarily brown trout and mountain whitefish, although rainbow and brook trout are present, along with native white, longnose, and mountain suckers, longnose dace, and mottled sculpin. Brown trout and mountain whitefish will primarily benefit from opened spawning and rearing habitat previously limited by a migration barrier. Rainbow trout may reestablish a spawning run with improved connectivity and habitat. Native suckers may also take advantage of improved passage, although no data is available to determine effects.

- B. How will the project protect or enhance wild fish habitat?:

The proposed fish bypass will enhance wild fish populations by opening access to previously restricted spawning and rearing habitats and minimizing entrainment into a canal for returning spawners and fry produced upstream of the canal. Currently, access to spawning areas upstream of the canal crossing is restricted April through October, interrupting spawning migrations of spring and fall spawning fish. Furthermore, any fry produced upstream of the canal are currently entrained on their downstream migrations during the irrigation season. Additional benefits to fish habitat will accrue through associated projects including the renaturalization of 700 feet of Dry Creek below the canal crossing and eliminating bankline erosion and reducing sediment loads by stabilizing 4,448 feet of eroding banklines; creating 0.68 acres of new inset floodplain area; and planting over 13,000 dormant willow stems, 3,500 containerized shrubs and hydroseeding all re-sloped banklines with native seed mixes. Decreased fine sediment loads will improve water quality and spawning habitat.

- C. Will the project improve fish populations and/or fishing? To what extent?:

The project will improve fish populations and fishing, especially in the East Gallatin River. With improved access to spawning habitats, cooler water, and holding and rearing cover, trout populations in the East Gallatin River should increase, or at least remain more stable during drought periods. Currently, spawning migrations upstream of the Canal are blocked, and any downstream emigrants would be entrained into the canal. Furthermore, decreased fine sediment loads may enhance spawning success. Increased recruitment of young fish will enhance resiliency of fish populations in Dry Creek and the East Gallatin River.

- D. Will the project increase public fishing opportunity for wild fish and, if so, how?:

Yes, by improving connectivity to more spawning habitat and restoring more consistent stream flows, improved recruitment should increase fish populations in the East Gallatin River which will benefit the popular nearby public fishery. Dry Creek will have improved fishing with improved habitat, but as a minor tributary does not attract much public fishing.

- E. The project agreement includes a 20-year maintenance commitment. Please discuss your ability to meet this commitment.

Dry Creek fish passage

The project partners have committed to continued maintenance of the bypass structure. Mr. Walker has granted a perpetual easement through his property necessary for construction and ongoing maintenance of the project. Dry Creek Partners LLC and the Dry Creek Canal Company have made arrangements for ongoing maintenance.

- F. What was the cause of habitat degradation in the area of this project and how will the project correct the cause?

Three primary limited factors have degraded aquatic habitat in the Dry Creek watershed. First, Dry Creek is naturally a sediment-rich basin, but fine sedimentation was exacerbated when Dry Creek was channelized for a railroad, county road and agriculture. For nearly a century, Dry Creek has been healing itself by re-establishing meanders and floodplains by lateral erosion. The upstream project will accelerate healing and decrease sediment loads. Second, Dry Creek's connection with the East Gallatin River was severed when the Dry Creek Canal intercepted the stream in the early 1900's. A diversion structure captured Dry Creek during the irrigation season, dewatering Dry Creek below the canal, and interrupting fish passage. Finally, Dry Creek was channelized in the reach between the canal and the East Gallatin River. In particular, the channel was straightened to increase farmable acres and to accommodate the canal. The straightened channel at the Dry Creek canal was designed to act as an irrigation blow-off. With little streamflow during hot summers, and channel forming flows interrupted by the canal, riparian vegetation and stream channel complexity suffered. Each of these limiting factors will be corrected to some extent, with decreased sedimentation from up-basin, restored year-round fish passage and flows, and renaturalized habitat in the reach downstream of the canal.

- G. What public benefits will be realized from this project?:

Improved connectivity between lower and upper Dry Creek will improve fish migrations and increase recruitment. Better holding cover and resting sites near the siphon will make the passage structure more attractive for migrating fish. Better access to upstream spawning habitat will improve fish numbers for the popular public fishery in the East Gallatin River. In late summer, fish will have access to cooler water upstream, where currently just a trickle survives. Finally, water quality and habitat impairments, as listed by DEQ on the 303(d) list, will be alleviated to a significant extent.

- H. Will the project interfere with water or property rights of adjacent landowners? (explain):

No. All adjacent landowners and property interests are participating in the project. Lonny Walker has conveyed an easement across his property for the fish bypass and has agreed to protect the investments in stream renaturalization. There are no water right implications, as the Dry Creek Canal does not have water rights in Dry Creek and is party to a project agreement.

- I. Will the project result in the development of commercial recreational use on the site?: (explain):

No

- J. Is this project associated with the reclamation of past mining activity?:

No

Each approved project applicant must enter into a written agreement with Montana Fish, Wildlife & Parks specifying terms and duration of the project. The applicant must obtain all applicable permits prior to project construction. A competitive bid process must be followed when using State funds.

IV. AUTHORIZING STATEMENT

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature:  Date: Nov 28, 2017

Sponsor (if applicable): _____

***Highlighted boxes will automatically expand.**

Mail To: Montana Fish, Wildlife & Parks
Fisheries Division
PO Box 200701
Helena, MT 59620-0701

E-mail To: Michelle McGree
mmcgree@mt.gov
(electronic submissions MUST be signed)

Incomplete or late applications will be rejected and returned to applicant.
Applications may be rejected if this form is modified.

*****Applications must be signed and *received* by the Future Fisheries Program Officer in Helena before December 1 and June 1 of each year to be considered for the subsequent funding period.*****

Dry Creek fish passage

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Both tables must be completed or the application will be returned

WORK ITEMS (ITEMIZE BY CATEGORY)	NUMBER OF UNITS	UNIT DESCRIPTION*	COST/UNIT	TOTAL COST	CONTRIBUTIONS			
					FUTURE FISHERIES REQUEST	IN-KIND SERVICES**	IN-KIND CASH	TOTAL
Personnel***								
Survey	1		\$4,146.00	\$ 4,146.00			4,146.00	\$ 4,146.00
Design	1		\$16,480.00	\$16,480.00			\$16,480	\$ 16,480.00
Permitting				\$ 2,340.00			2,340.00	\$ 2,340.00
Wetland Delineation	25	hr	\$80.00	\$2,000.00			2,000.00	\$2,000
Oversight (TU)	10	hr	\$55.00	\$ 550.00		550.00		\$ 550.00
Oversight (Gillilan)	5	hr	\$110.00	\$ 550.00	550.00			
			Sub-Total	\$ 25,516.00	\$ -	\$ 1,100.00	\$ 24,966.00	\$ 25,516.00
Travel								
Mileage				\$ 142.00		142.00		\$ 142.00
Per diem				\$ -				\$ -
			Sub-Total	\$ 142.00	\$ -	\$ 142.00	\$ -	\$ 142.00
Construction Materials****								
Canal liner	30	square yds	\$30.00	\$ 900.00	900.00			\$ 900.00
Rock -grade control	49	cy	\$100.00	\$ 4,900.00	4,900.00			\$ 4,900.00
Rock- gravels	147	cy	\$40.00	\$ 5,880.00			5,880.00	\$ 5,880.00
Plantings	1	lump sum	\$2,000.00	\$ 2,000.00	2,000.00			\$ 2,000.00
Culvert - 6x4 box	36	linear foot	\$935.00	\$ 33,660.00	33,660.00			\$ 33,660.00
Culvert headwalls	4	each	\$1,034.00	\$ 4,136.00	4,136.00			\$ 4,136.00
Headgate	2	each	\$1,723.00	\$ 3,446.00			3,446.00	\$ 3,446.00
seeding	1	acre	\$375.00	\$ 375.00	375.00			\$ 375.00
Contingency (30% of total preliminary construction estimate)	1	lump sum		\$ 22,230.00			22,230.00	\$ 22,230.00
			Sub-Total	\$ 77,527.00	\$ 45,971.00	\$ -	\$ 31,556.00	\$ 77,527.00
Equipment and Labor								
Earthwork canal	30	cy	\$65.00	\$ 1,950.00	1,950.00			\$ 1,950.00
Topsoil, strip, stockpile, replace	103	cy	\$10.00	\$ 1,030.00			1,030.00	\$ 1,030.00
Earthwork cut	832	cy	\$5.00	\$ 4,160.00			4,160.00	\$ 4,160.00
Earthwork fill	140	cy	\$5.00	\$ 700.00			700.00	\$ 700.00
Excess soil disposal	692	cy	\$4.00	\$ 2,768.00			2,768.00	\$ 2,768.00
Water control	1	lump sum	\$4,000.00	\$ 4,000.00			4,000.00	\$ 4,000.00
			Sub-Total	\$ 14,608.00	\$ 1,950.00	\$ -	\$ 12,658.00	\$ 14,608.00
Mobilization								
Mobilization	1	lump sum	\$2,097.00	\$ 2,097.00	600.00		1,497.00	\$ 2,097.00
Tax, Bond, Insurance	1	lump sum	\$2,097.00	\$ 2,097.00			2,097.00	\$ 2,097.00
			Sub-Total	\$ 4,194.00	\$ 600.00	\$ -	\$ 3,594.00	\$ 4,194.00
TOTALS				\$ 121,987.00	\$ 48,521.00	\$ 1,242.00	\$ 72,774.00	\$ 121,987.00

OTHER REQUIREMENTS:

All of the columns in the budget table and the matching contribution table MUST be completed appropriately or the application will be invalid. Please see the example budget sheet for additional clarification.

*Units = feet, hours, inches, etc. Do not use lump sum unless there is no other way to describe the costs.

**Can include in-kind materials. Justification for in-kind labor (e.g. hourly rates used for calculations). Describe here or in text.

Reminder: Government salaries cannot be used as in-kind match

***The Review Panel suggests that design and oversight costs associated with a proposed project not exceed 15% of the total project budget. If design and oversight costs are in excess of 15%, applications must include a minimum of two competitive bids for the cost of undertaking the project.

****The Review Panel recommends a maximum fencing cost of \$1.50 per foot. Additional costs may be the responsibility of the applicant and/or partners.

MATCHING CONTRIBUTIONS (do not include requested funds)

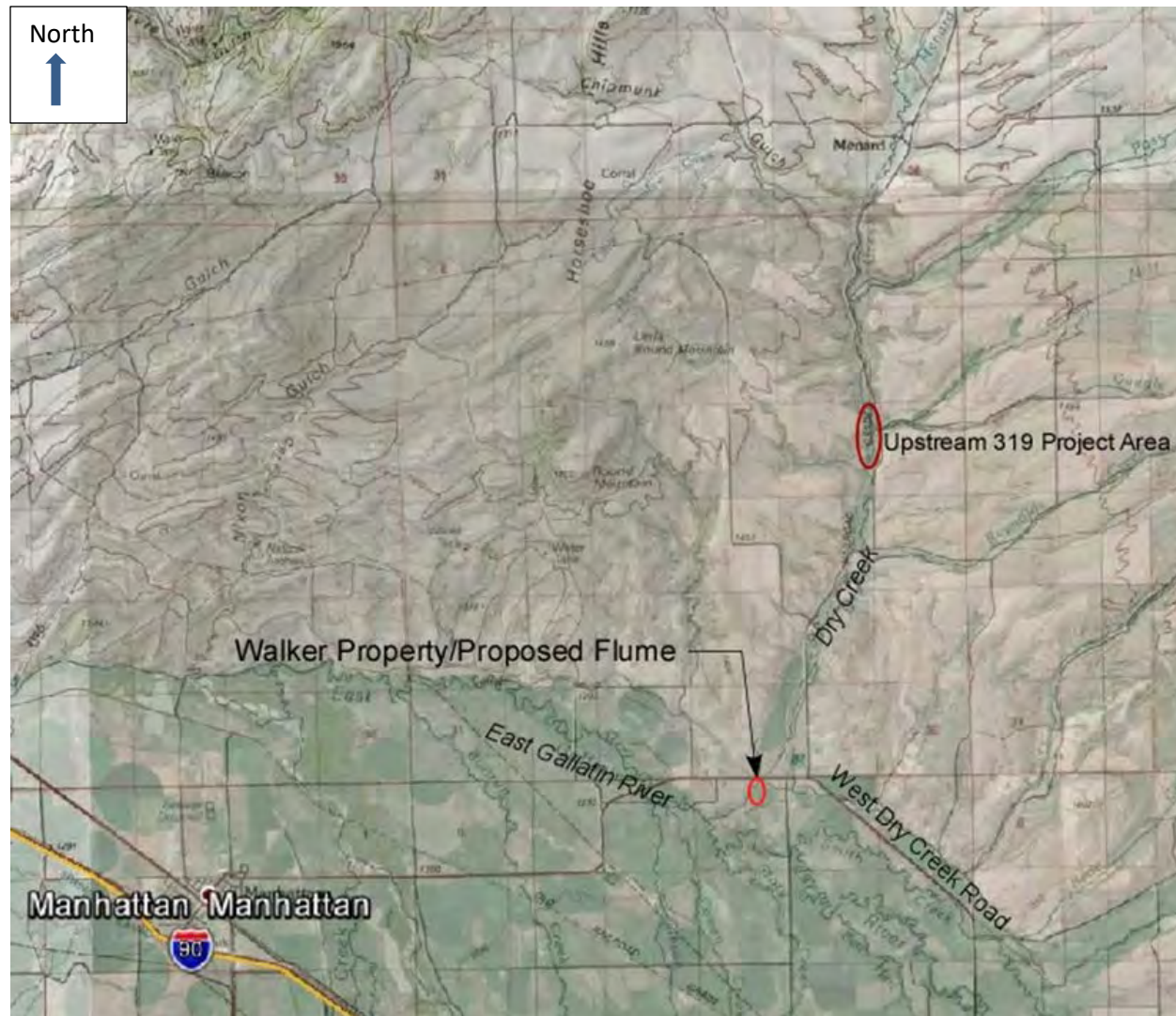
CONTRIBUTOR	IN-KIND SERVICE	IN-KIND CASH	TOTAL	Secured? (Y/N)
Dry Creek Partners	\$ -	\$ 72,774.00	\$ 72,774.00	yes
Trout Unlimited	\$ 692.00	\$ -	\$ 692.00	yes
Gillilan Associates	\$ 550.00	\$ -	\$ 550.00	yes
Volunteer Labor		\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
TOTALS	\$ 1,242.00	\$ 72,774.00	\$ 74,016.00	

Dry Creek fish passage



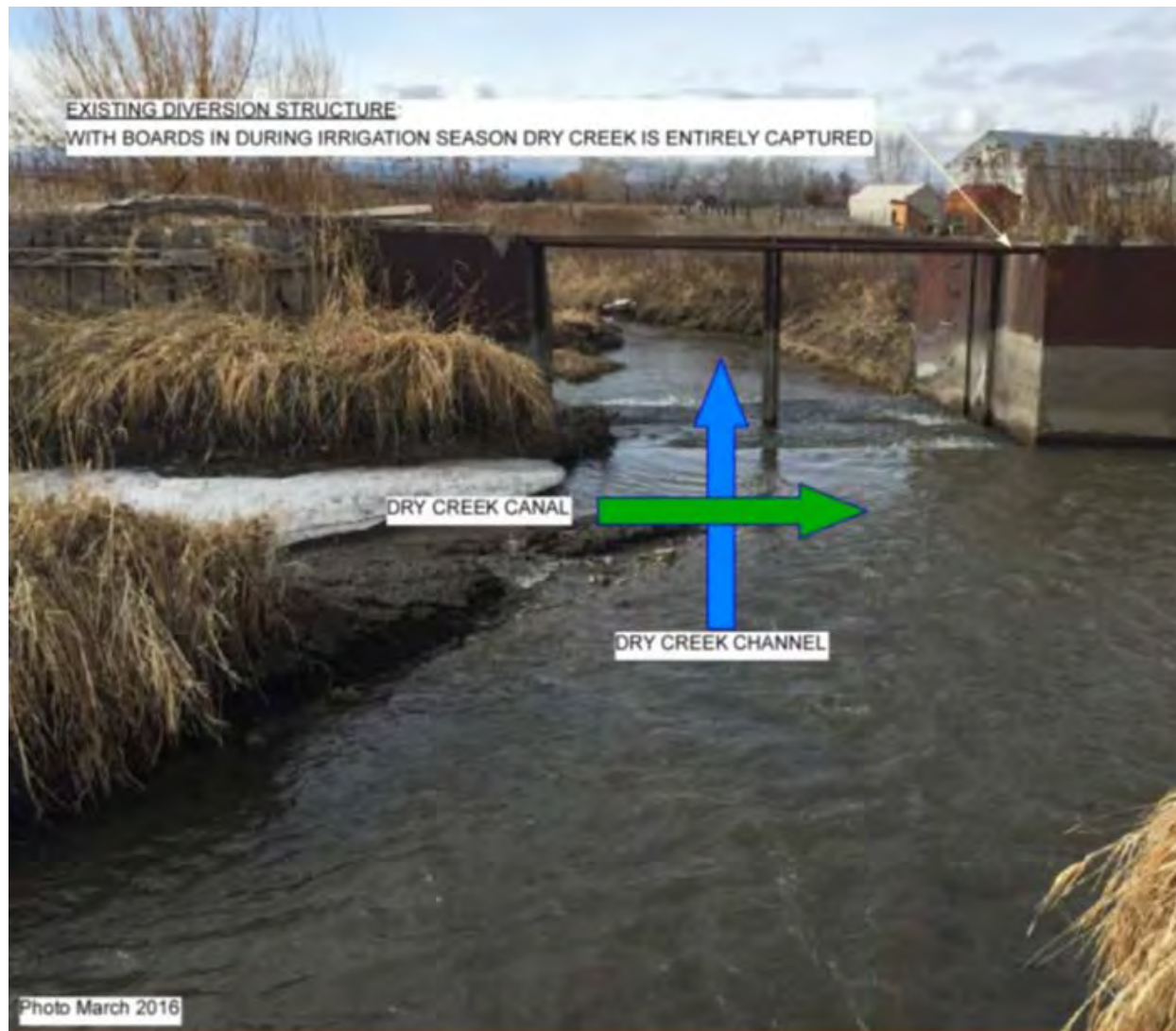
Map of Walker property (outlined in blue) with proposed restoration reach (in red), fish bypass (yellow) and Dry Creek Canal (in light green), from Montana Cadastral website.

Dry Creek fish passage



Map of proposed Walker Property project and relationship to its confluence with the East Gallatin River, the Dry Creek Canal, and the proposed upstream 319 grant funded project.

Dry Creek fish passage



March 2016 photograph at junction of Dry Creek with Dry Creek Canal at low water, viewed from upstream of canal. Between April and October, splash boards are installed in headgate structure, blocking flow into Dry Creek downstream of junction.



MEMO

To: Scott Gillilan, Gillilan Associates, Inc.

From: Paul Sanford, PE, Allied Engineering Services, Inc.

Project Name: Dry Creek Crossing at Dry Creek Canal

Project Number: 16-015

Date: August 11, 2017

Re: Fish Bypass Channel – Preliminary Feasibility Evaluation

Introduction and Background

The purpose of this Memo is to provide a preliminary feasibility evaluation for a fish bypass structure as an alternative to a flume or siphon. A flume and siphon was previously evaluated by Allied Engineering and summarized in a report dated May 9, 2016. The site is located in Gallatin County at latitude, longitude = 45.874786, -111.207557.

The goal of the fish bypass system would be to reconnect the lower reaches of Dry Creek below the canal with its upper reaches to help restore the fishery. Some elements of the fish bypass structure include:

- Route lower flows under the Dry Creek Canal in a culvert constructed with fish passage features;
- Larger flows would be routed through the headgate on Dry Creek or into the canal if the headgate is closed. This is consistent with how larger flows are currently handled at the site; and
- Minimal modifications to the Dry Creek Canal Company's infrastructure at the site.

Preliminary Design Criteria

Preliminary design criteria are listed below.

1. Design flow: 20 to 40 cfs was considered for this preliminary feasibility evaluation but the design range of flows will need to be established.
2. Minimum depth of flow in bypass channel and culvert: 0.5 feet was considered for this preliminary feasibility evaluation but the value will need to be established.
3. Maximum velocity of flow in bypass channel: 4.0 feet/second considered for this preliminary feasibility evaluation but the value(s) will need to be established.

4. Flood Considerations: The alternative should not result in increased flood hazard from Dry Creek when compared to the pre-project condition.
5. Fish Passage: The principle objective is to provide connectivity during the irrigation season when the Dry Creek headgate (Hydraulic Structure 2) is closed.

Preliminary Fish Bypass Channel Feasibility Evaluation

The fish bypass structure would connect Dry Creek by routing a portion of the Dry Creek flow around the Dry Creek Headgate (Hydraulic Structure 2 on the attached Figure 1). There is roughly 3.5 to 4 feet of drop across Hydraulic Structure 2. It appears that a bypass alignment located east of Dry Creek would be more practical than one located west of the creek. Refer to the attached Figure 2.1 for a conceptual alignment located east of Dry Creek. The conceptual alignment shown on Figure 2.1 is roughly 110 feet in length.

Listed from upstream to downstream, the following elements are anticipated components of the fish bypass structure (refer to Figure 2.1 for conceptual location of the components):

- Headgate on left bank (looking downstream along Dry Creek) of Dry Creek;
- Potentially a headgate on Dry Creek downstream of the above listed headgate. This headgate would be activated (i.e. boards put in or other means) when the boards are in place on Hydraulic Structure 2. This would need to be reviewed/analyzed in more detail;
- Open channel rock lined fish bypass from headgate to Dry Creek Canal;
- Culvert with fish passage features under canal; and
- Open channel rock lined fish bypass from culvert to Dry Creek.

The fish bypass culvert crossing under the canal is limited in height. Starting with an elevation of 4289.5 on the bed of Dry Creek downstream of Hydraulic Structure 2 and moving upstream along the fish bypass channel at a slope of 0.005 ft/ft, gives an approximate culvert flowline elevation of 4289.8 under the canal. The canal bottom has an elevation of about 4293.8 at the fish bypass crossing. Therefore, there would be roughly four vertical feet from the culvert flowline to the canal flowline. Some of this available height will be consumed by the top thickness of the culvert (up to about eight inches for a concrete culvert). Additional available height will be consumed by the requirement for cover over the culvert (the required vertical height from top of culvert to flowline of canal). A cover as low as 0.5 feet may be acceptable but would likely require the canal to be lined for a segment over the culvert. Accounting for the culvert thickness and cover requirements, a culvert with an inside height (installed inside height – i.e. a 4-ft culvert buried 1-ft would have an inside height of 3-ft) of somewhere between 2.5 feet and 3.5 feet would be the tallest feasible culvert at the canal crossing. Also, it appears the culvert flowline elevation at each end of the culvert would be roughly eight feet below the existing ground elevation. This would require the culvert to have headwalls at both ends and would also present some challenges to grading the fish bypass open channel.

For the downstream segment of the fish bypass channel, a trapezoidal rock lined open channel with the following characteristics would meet the preliminary design criteria listed earlier in this Memo:

- Channel Slope = 0.005 ft/ft
- Bottom width = 8.0 feet
- Side slopes = 2H:1V

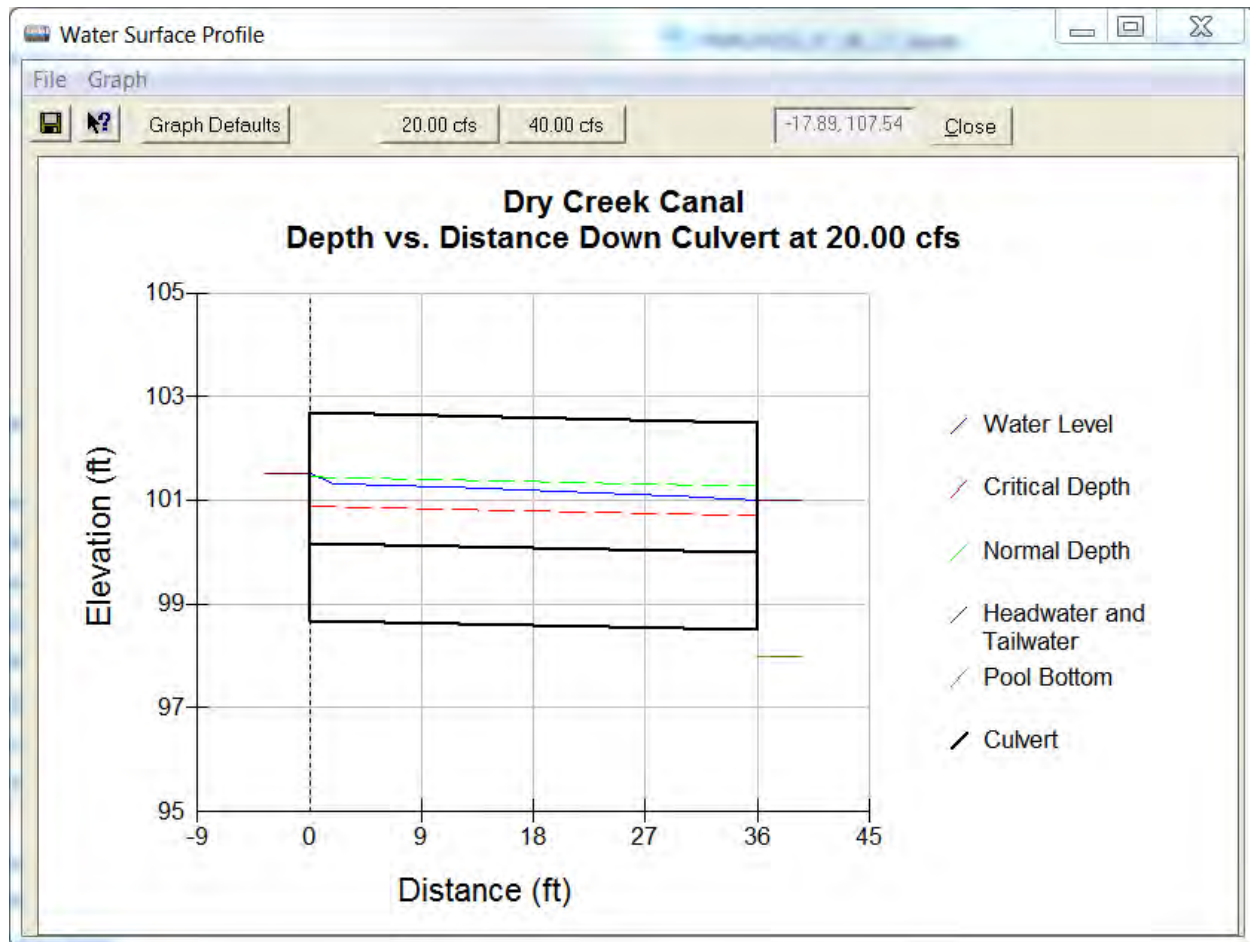
Other bottom widths may also prove feasible but with a bottom width of eight feet, a flow depth of about one-foot would occur for a flow rate of 20 cfs.

The upstream end of the culvert would have an elevation of roughly 4289.9 and the elevation of Dry Creek at the fish bypass headgate location is roughly 4293.6. For the alignment shown in blue on Figure 2.1, this means the open channel fish bypass between the upstream end of the culvert and the headgate on Dry Creek would need to burn roughly 3.7 feet of elevation in roughly 30 feet. This might be accomplished with steps and a roughened channel to provide acceptable hydraulics for fish passage. Also, the headgate could be moved further upstream to provide more channel length for the upstream portion of the fish bypass channel.

The computer program FishXing version 3 was used to complete a preliminary analysis for a fish passage culvert. For a flow range of 20 to 40 cfs, it was found that a box culvert with a width of roughly six to eight feet would be required. A box culvert was evaluated for simplicity at this preliminary feasibility evaluation stage. The following parameters were input into the program:

- Culvert length = 36 feet
- Culvert type: concrete box culvert
- Embedment depth: 1.5 feet
- Mannings n roughness at bottom of culvert = 0.045
- Culvert slope = 0.005 ft/ft
- Max water velocity = 4 ft/s
- Min water depth = 0.5 ft
- Tailwater condition: 1-ft of depth at downstream end of culvert

With these criteria, a six foot wide box culvert presented no barrier to fish passage for a flow rate of 20 cfs. However, at 40 cfs the velocity in the culvert ranged from about 4 fps to 5 fps for most of the culvert length with over 5 fps in the most downstream few feet of the culvert. An eight foot wide box culvert met the velocity criteria except for the last 10 feet of the culvert where the velocity ranged from 4 to 5 fps. It is possible that design elements (roughness, tailwater, etc.) could be adjusted so that an eight foot wide and possibly a six foot wide box culvert would meet the velocity criteria. A figure from the FishXing program showing a culvert profile at 20 cfs is provided below.



Summary

Based on the preliminary design criteria and assumptions discussed above and preliminary analysis, it appears that a fish bypass structure is feasible from a geometric and hydraulic standpoint. Challenges include the depth of the culvert relative to existing ground, limited cover over the canal, and a steep grade from the headgate to the culvert.

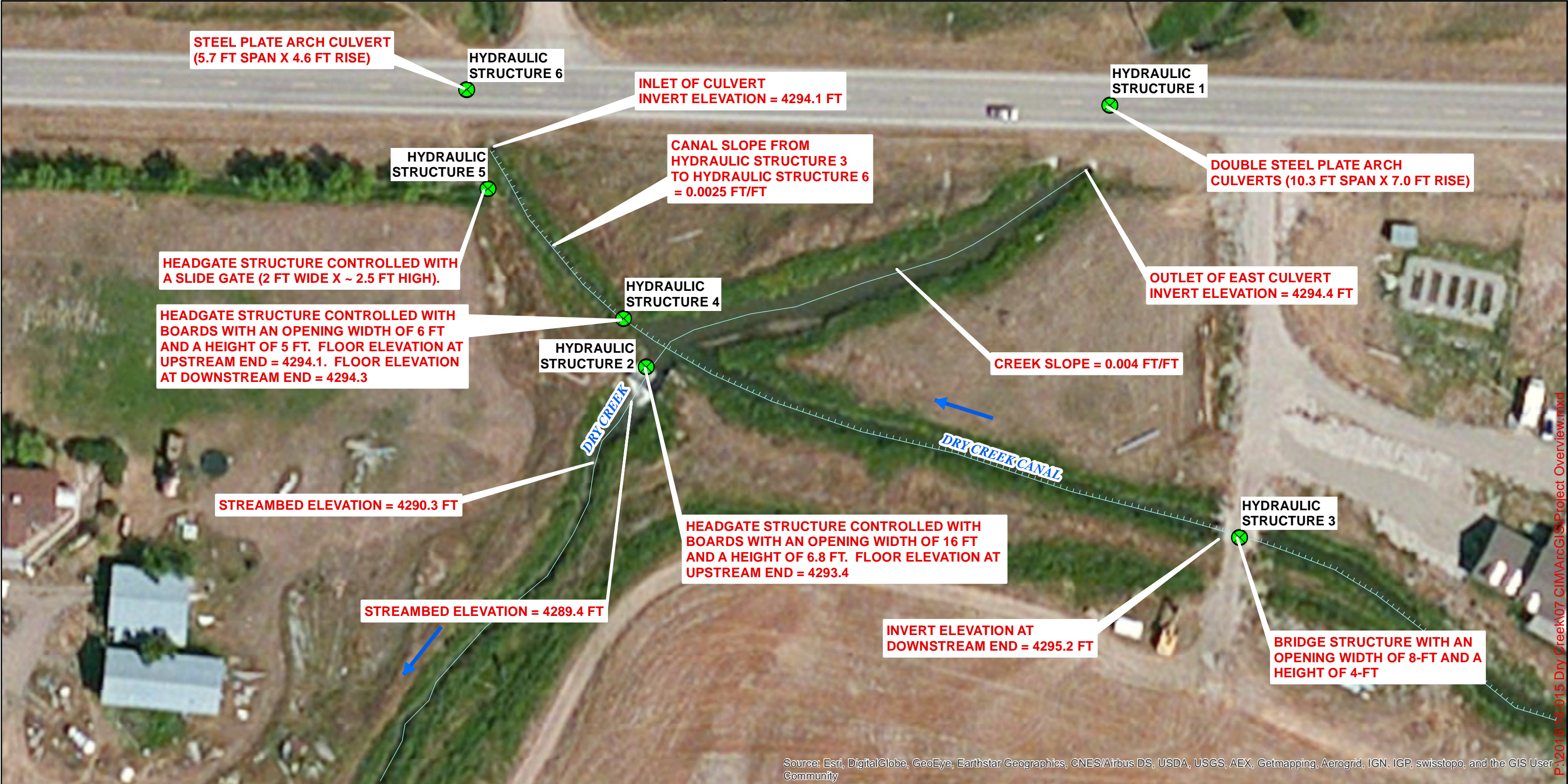
Attachments

Figure 1 from Appendix A of the May 9, 2016 Report

Figure 2.1 from Appendix D of the May 9, 2016 Report

Fish Bypass Downstream Channel Hydraulic Analysis Report (Flowmaster)

FishXing Reports



LEGEND

- HYDRAULIC STRUCTURES
- DRY CREEK
- DRY CREEK CANAL



1 inch = 50 feet

0 25 50 75 Feet

REFERENCES:

DRY CREEK
EXISTING CONDITIONS
GALLATIN COUNTY, MT

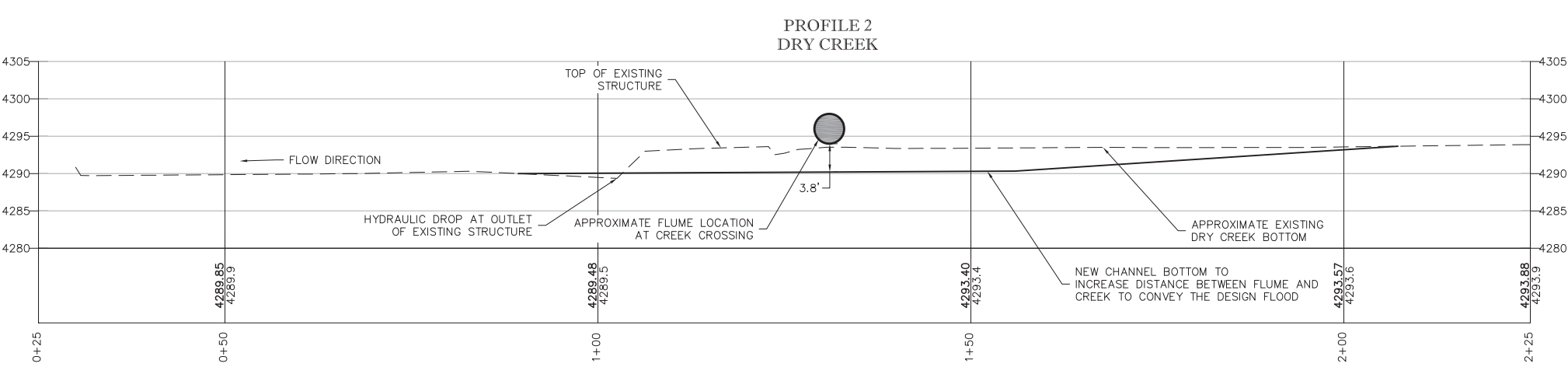
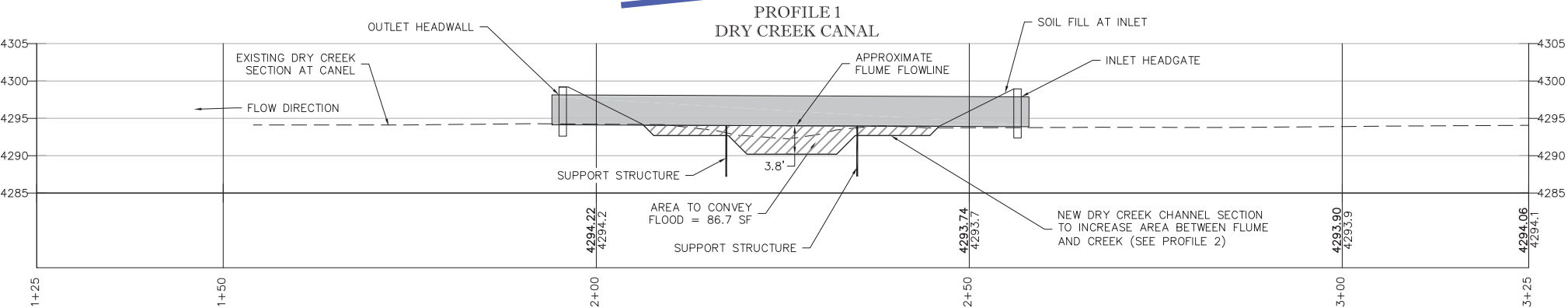
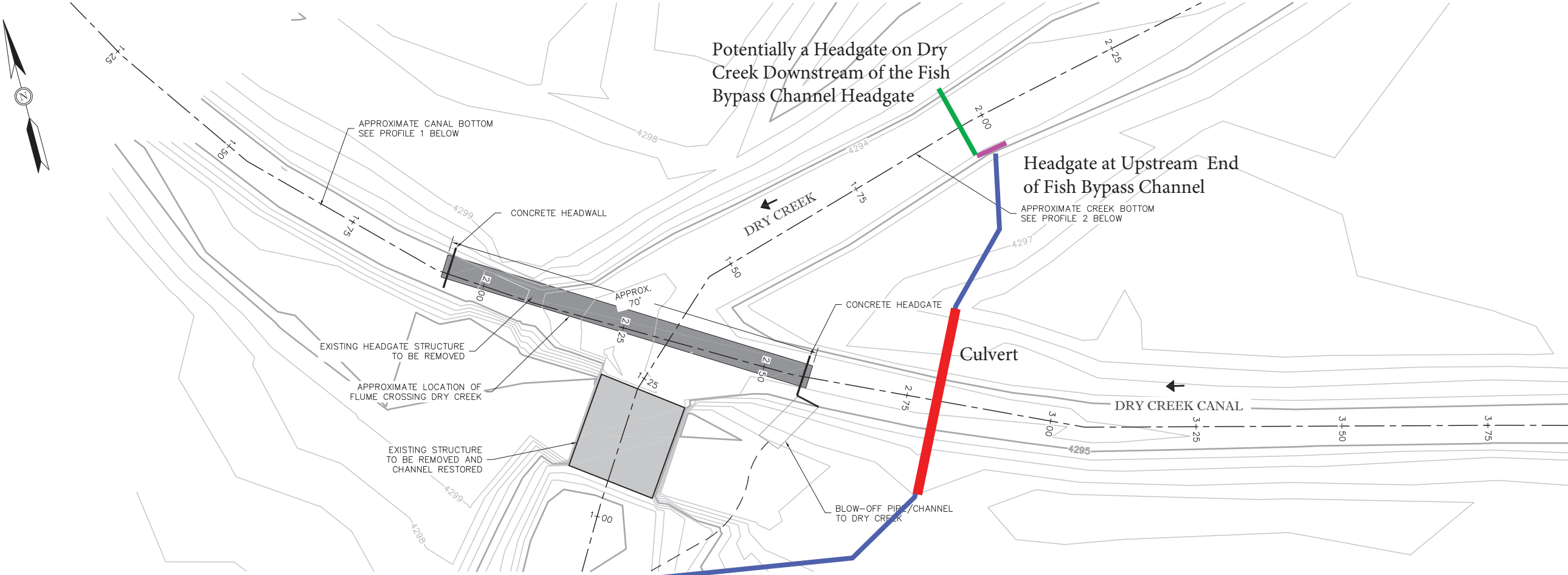
32 DISCOVERY DRIVE
BOZEMAN, MT 59718
PHONE (406) 582-0221
FAX (406) 582-5770
www.alliedengineering.com

Civil Engineering
Geotechnical Engineering
Land Surveying
Construction Testing & Inspection



FIGURE: 1
DRAWN BY: JWJ
DATE: 5/8/2016
PROJECT: 16-015

Dry Creek fish passage



C:\Users\w\Documents\2016\16-015 Dry Creek\28 CAD-Production\VI & H\Dry Creek Crossing Drawings.dwg

Cross Section for Trapezoidal Channel - DS Fish Bypass Channel

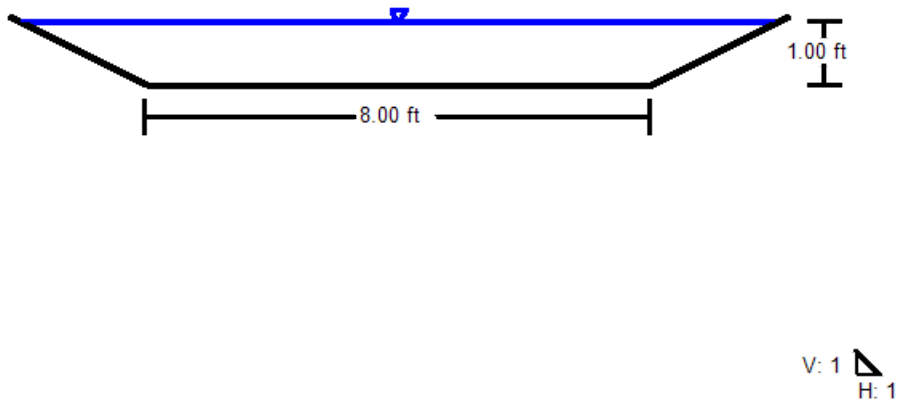
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.00500	ft/ft
Normal Depth	1.00	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	8.00	ft
Discharge	20.00	ft ³ /s

Cross Section Image



Crossing Report for Dry Creek Canal

Project: 16-015DryCreek

Crossing Location Information

Crossing Name: Dry Creek Canal

Stream Name: Dry Creek

45.87479 Degrees N Latitude, 111.2076 Degrees W Longitude

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 4 ft/s

Minimum Required Depth = 0.5 ft

Maximum Allowed Outlet Drop = 0.5 ft

Crossing Installation Data

Culvert Type: 6 X 4 ft Box

Material: Concrete

Installation: Embedded

Countersunk Depth: 1.5 ft

Natural Bottom Roughness Coefficient: 0.045

Culvert Length: 36 ft

Culvert Slope: 0.50%

Culvert Roughness Coefficient: 0.013

Natural Bottom Roughness Coefficient: 0.045

Inlet Invert Elevation: 100.18 ft

Outlet Invert Elevation: 100 ft

Inlet Headloss Coefficient (Ke): 0.5

Design Flows

Low Passage Flow: 20 cfs

High Passage Flow: 40 cfs

Tailwater Information

Tailwater Option: Constant Tailwater

Constant Tailwater Elevation: 101 ft

Outlet-Pool Bottom Elevation: 98 ft

Dry Creek fish passage

Table 1. Fish Passage Summary.

Fish Passage Summary	
Low Passage Design Flow	20.00 cfs
High Passage Design Flow	40.00 cfs
Percent of Flows Passable	20.0 %
Passable Flow Range	20.00 to 24.00 cfs
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier	24.00 cfs to 40.00 cfs
Pool Depth Barrier	None

Table 2. Culvert Rating Table.

Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0	0.82	0.00	1.00	0.00	3.00	NONE
2	0.83	0.49	1.00	0.00	3.00	NONE
4	0.85	0.96	1.00	0.00	3.00	NONE
6	0.87	1.41	1.00	0.00	3.00	NONE
8	0.89	1.83	1.00	0.00	3.00	NONE
10	0.93	2.20	1.00	0.00	3.00	NONE
12	0.97	2.53	1.00	0.00	3.00	NONE
14	1.00	2.81	1.00	0.00	3.00	NONE
16	1.00	3.10	1.00	0.00	3.00	NONE
18	1.00	3.33	1.00	0.00	3.00	NONE
20.00	1.00	3.54	1.00	0.00	3.00	NONE
22	1.00	3.74	1.00	0.00	3.00	NONE
24	1.00	4.00	1.00	0.00	3.00	NONE
26	1.00	4.33	1.00	0.00	3.00	V
28	1.00	4.67	1.00	0.00	3.00	V
30	1.00	5.00	1.00	0.00	3.00	V
32	1.00	5.33	1.00	0.00	3.00	V
34	1.00	5.67	1.00	0.00	3.00	V
36	1.00	6.00	1.00	0.00	3.00	V
38	1.00	6.33	1.00	0.00	3.00	V
40.00	1.00	6.67	1.00	0.00	3.00	V
42	1.00	7.00	1.00	0.00	3.00	V
44	1.00	7.33	1.00	0.00	3.00	V
46	1.00	7.67	1.00	0.00	3.00	V
48	1.00	8.00	1.00	0.00	3.00	V
50	1.00	8.33	1.00	0.00	3.00	V
52	1.00	8.67	1.00	0.00	3.00	V
54	1.00	9.00	1.00	0.00	3.00	V
56	1.00	9.33	1.00	0.00	3.00	V
58	1.01	9.55	1.00	0.01	3.00	V
60	1.04	9.65	1.00	0.04	3.00	V

Crossing Report for Dry Creek Canal

Project: 16-015DryCreek

Crossing Location Information

Crossing Name: Dry Creek Canal

Stream Name: Dry Creek

45.87479 Degrees N Latitude, 111.2076 Degrees W Longitude

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 4 ft/s

Minimum Required Depth = 0.5 ft

Maximum Allowed Outlet Drop = 0.5 ft

Crossing Installation Data

Culvert Type: 8 X 4 ft Box

Material: Concrete

Installation: Embedded

Countersunk Depth: 1.5 ft

Natural Bottom Roughness Coefficient: 0.045

Culvert Length: 36 ft

Culvert Slope: 0.50%

Culvert Roughness Coefficient: 0.013

Natural Bottom Roughness Coefficient: 0.045

Inlet Invert Elevation: 100.18 ft

Outlet Invert Elevation: 100 ft

Inlet Headloss Coefficient (Ke): 0.5

Design Flows

Low Passage Flow: 20 cfs

High Passage Flow: 40 cfs

Tailwater Information

Tailwater Option: Constant Tailwater

Constant Tailwater Elevation: 101 ft

Outlet-Pool Bottom Elevation: 98 ft

Dry Creek fish passage

Table 1. Fish Passage Summary.

Fish Passage Summary	
Low Passage Design Flow	20.00 cfs
High Passage Design Flow	40.00 cfs
Percent of Flows Passable	60.0 %
Passable Flow Range	20.00 to 32.00 cfs
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier	32.00 cfs to 40.00 cfs
Pool Depth Barrier	None

Table 2. Culvert Rating Table.

Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0	0.82	0.00	1.00	0.00	3.00	NONE
2	0.83	0.37	1.00	0.00	3.00	NONE
4	0.84	0.73	1.00	0.00	3.00	NONE
6	0.85	1.07	1.00	0.00	3.00	NONE
8	0.87	1.41	1.00	0.00	3.00	NONE
10	0.89	1.72	1.00	0.00	3.00	NONE
12	0.91	2.01	1.00	0.00	3.00	NONE
14	0.94	2.29	1.00	0.00	3.00	NONE
16	0.97	2.54	1.00	0.00	3.00	NONE
18	0.99	2.78	1.00	0.00	3.00	NONE
20.00	1.00	2.97	1.00	0.00	3.00	NONE
22	1.00	3.17	1.00	0.00	3.00	NONE
24	1.00	3.35	1.00	0.00	3.00	NONE
26	1.00	3.51	1.00	0.00	3.00	NONE
28	1.00	3.66	1.00	0.00	3.00	NONE
30	1.00	3.80	1.00	0.00	3.00	NONE
32	1.00	4.00	1.00	0.00	3.00	NONE
34	1.00	4.25	1.00	0.00	3.00	V
36	1.00	4.50	1.00	0.00	3.00	V
38	1.00	4.75	1.00	0.00	3.00	V
40.00	1.00	5.00	1.00	0.00	3.00	V
42	1.00	5.25	1.00	0.00	3.00	V
44	1.00	5.50	1.00	0.00	3.00	V
46	1.00	5.75	1.00	0.00	3.00	V
48	1.00	6.00	1.00	0.00	3.00	V
50	1.00	6.25	1.00	0.00	3.00	V
52	1.00	6.50	1.00	0.00	3.00	V
54	1.00	6.75	1.00	0.00	3.00	V
56	1.00	7.00	1.00	0.00	3.00	V
58	1.00	7.25	1.00	0.00	3.00	V
60	1.00	7.50	1.00	0.00	3.00	V



**Montana Department
of
Fish, Wildlife & Parks**

Region 3 Headquarters

1400 S 9th

Bozeman, MT 59718

November 28, 2017

Montana Fish, Wildlife & Parks
Fisheries Division
1420 E. Sixth Ave.
P.O. Box 200701
Helena, MT 59620-0701

Re: Dry Creek Habitat Connectivity

To whom it may concern,

I wish to express my support for proposed reconnection of flows on Dry Creek, a significant tributary to the Gallatin River. Cold-water biological communities in Dry Creek and in the Gallatin River are heavily impacted by low flows during summer months. Lower flows, earlier run-off, and warmer temperatures in the lower Gallatin River and Dry Creek are detrimental to trout populations. In these circumstances, the ability for fish to move unhindered is critically important for recruitment, growth, and ultimately survival of individuals and populations.

As a management biologist, it has become very clear in recent years that volume of flow along with habitat heterogeneity are critical factors determining trout densities and resilience of aquatic communities. This proposed project will allow expression of several life histories, including fluvial migration and the ability to seek refuge during critical summer months. If you have further questions regarding this project, please feel free to contact me at (406) 994-6938. Finally, I hope that if this project is completed, other similar projects will be developed elsewhere in Montana

Sincerely,

A handwritten signature in blue ink, appearing to read 'David C Moser'. The signature is stylized with a large, looped 'D' and 'M'.

David C Moser
Fisheries Biologist